



**FCC PART 15C
TEST REPORT
No. I18N00281-SRD**

For

AEOTEC LIMITED

TriSensor

Model Name: ZWA005-A

With

Hardware Version: v1.0

Software Version: v1.0

FCC ID: 2AOGIZWA005

Issued Date: 2018-05-07

Designation Number: CN1210

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18N00281-SRD	Rev.0	1st edition	2018-05-07

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1. Test Laboratory

1.1. Testing Location

Location: Shenzhen Academy of Information and Communications Technology
Address: Building G, Shenzhen International Innovation Center, No.1006
Shennan Road, Futian District, Shenzhen, Guangdong Province
Postal Code: 518026
Telephone: +86(0)755-33322000
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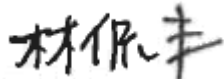
1.2. Testing Environment

Normal Temperature: 15-30℃
Extreme Temperature: -10/+55℃
Relative Humidity: 35-60%

1.3. Project Data

Testing Start Date: 2018-03-05
Testing End Date: 2018-04-25

1.4. Signature



Lin Kanfeng
(Prepared this test report)



Tang Weisheng
(Reviewed this test report)



Zhang Bojun
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name: AEOTEC LIMITED
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ROAD, MONG KOK, KL
City: MONG KOK
Postal Code: /
Country: KL
Telephone: 13590229631
Fax: /

2.2. Manufacturer Information

Company Name: SHENZHEN TOP-ACCESS ELECTRONICS Co, LTD.
Address: A17 BUILDING, Silicon valley power Pioneer Park,#334 Guiyue Rd.,
Guanlan, Longhua District, Shenzhen City, Guangdong, China
City: Shenzhen
Postal Code: /
Country: China
Telephone: 13510688045
Fax: 86-755-29503653

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	TriSensor
Model Name	ZWA005-A
Market Name	/
Operating Frequency	908.40MHz/908.42MHz/916 MHz
FCC ID	2AOGIZWA005

3.2. Internal Identification of EUT Used during the Test

EUT ID*	IMEI	HW Version	SW Version	Receive Date
EUT1	/	v1.0	v1.0	2018-03-05

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE Used during the Test

AE ID*	Description	SN	Reversion
AE1	/	/	/

*AE ID: is used to identify the test sample in the lab internally.

3.4. General Description

This is a product supporting Z-Wave with 908.40/908.42/916 MHz technologies.

Manuals and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

Manufacturer's declaration: The Z-Wave antenna is a trace antenna on the PCB. The trace antenna has a gain of 2.5dBi.

4. Reference Documents

4.1. Documents Supplied by the Applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

4.2. Regulations and Standards

The following documents listed in this section are referred for testing.

Reference	Title	Version
CFR 47 Part 15	Part 15 -- Radio Frequency Devices. Subpart C -- Intentional Radiators. § 15.35 Measurement detector functions and bandwidths. § 15.207 Conducted limits. § 15.209 Radiated emission limits, general requirements. § 15.215 Additional provisions to the general radiated emission limitations. § 15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.	2016
ANSI C63.10	American National Standard for Testing Unlicensed Wireless Devices	2013

5. Test Results

5.1. Summary of Test Results

No	Test cases	Standard Sub-clause	Verdict
0	Antenna Requirement	15.203	P
1	Occupied 20dB Bandwidth	15.215, 15.249	P
2	Occupied Bandwidth	15.215, 15.249	P
3	Radiated Emissions	15.207, 15.209, 15.249	P

See **ANNEX A** and **ANNEX B** for details.

5.2. Statements

SAICT has evaluated the test cases requested by the applicant/manufacture as listed in section 5.1 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2.

5.3. Terms used in the result table

Terms used in Verdict column

P	Pass
NA	Not Available
F	Fail

Abbreviations

AC	Alternating Current
AFH	Adaptive Frequency Hopping
BW	Band Width
E.I.R.P.	equivalent isotropical radiated power
ISM	Industrial, Scientific and Medical
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
Tx	Transmitter

5.4. Laboratory Environment

Semi-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	< ±4dB, 3m/10m distance, from 30 to 1000 MHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 3000 MHz

Shielded room did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω

Fully-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Voltage Standing Wave Ratio (VSWR)	≤6dB, from 1 to 18 GHz, 3m distance

6. Test Facilities Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Vector Signal Analyzer	FSV40	100903	Rohde & Schwarz	2019-01-17	1 year

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Chamber	FACT3-2.0	1285	ETS-Lindgren	2019-11-27	3 years
2	Test Receiver	ESR7	101676	Rohde & Schwarz	2018-11-29	1 year
3	BiLog Antenna	VULB9163	9163 329	Schwarzbeck	2020-02-27	3 years
4	Horn Antenna	3117	00066585	ETS-Lindgren	2019-04-05	3 years
5	Spectrum Analyser	FSV40	102192	Rohde & Schwarz	2018-05-22	1 year
6	Pre-Amplifier	SCU-03	100356	R&S	/	/

7. Measurement Uncertainty

Test Name	Uncertainty
Occupied 20dB Bandwidth	$\pm 66\text{Hz}$
Occupied Bandwidth	$\pm 66\text{Hz}$
Radiated Emissions	$\pm 1.41\text{dB}$

ANNEX A: MEASUREMENT RESULTS

A.0 Antenna requirement

Measurement Limit:

Standard	Requirement
FCC CRF Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, § 15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Conclusion: The Directional gains of antenna used for transmitting is 2.5 dBi.
The RF transmitter uses an integrate antenna without connector.

A.1 Occupied 20dB Bandwidth

Measurement Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 5 times the OBW, centered on a hopping channel

RBW = 1% to 5% the OBW

VBW = 3*RBW

Sweep = auto

Detector function = peak

Trace = max hold

Measurement Limit:

Standard	Limit (kHz)
FCC 47 CFR Part 15.215, 15.249	/

Measurement Result:

Channel	Frequency(MHz)	20dB Bandwidth(kHz)		conclusion
908.42(9.6kbps)	908.42	Fig.1	60.78	P
908.4(40kbps)	908.4	Fig.2	54.41	P
916(100kbps)	916	Fig.3	73.52	P

See ANNEX B for test graphs.

Conclusion: PASS

A.2 Occupied Bandwidth

Measurement Procedure

Use the following spectrum analyzer settings:

Span = approximately 1.5 to 5 times the OBW, centered on a hopping channel

RBW = 1% to 5% the OBW

VBW = 3*RBW

Sweep = auto

Detector function = peak

Trace = max hold

Measurement Limit:

Standard	Limit (kHz)
FCC 47 CFR Part 15.215, 15.249	/

Measurement Result:

Channel	Frequency(MHz)	Occupied Bandwidth(kHz)		conclusion
908.42(9.6kbps)	908.42	Fig.4	57.89	P
908.4(40kbps)	908.4	Fig.5	53.84	P
916(100kbps)	916	Fig.6	75.54	P

See ANNEX B for test graphs.

Conclusion: PASS

A.3 Radiated Emissions

Transmitter Spurious Emission - Radiated

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.207, 15.209, 15.249	/

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (microvolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Frequency of emission (MHz)	Field strength(μ V/m)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Condition

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	120kHz/300kHz	5
1000-4000	1MHz/3MHz	15
4000-18000	1MHz/3MHz	40
18000-26500	1MHz/3MHz	20

For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

Note:

According to the performance evaluation, the radiated emission margin of EUT is over 20dB in the band below 30MHz. Therefore, the measurement starts from 30MHz to tenth harmonic.

The measurement results include the horizontal polarization and vertical polarization measurements.

Measurement Results:

Mode	Frequency (MHz)	Result	conclusion
908.42(9.6kbps)	908.42	Fig.7	P
908.4(40kbps)	908.4	Fig.8	P
916(100kbps)	916	Fig.9	P

Mode	Frequency (MHz)	Frequency Range	Test Results	Conclusion
908.42(9.6kbps)	908.42	30 MHz ~1 GHz	Fig.10	P
		1 GHz ~10GHz	Fig.11	P
908.4(40kbps)	908.4	30 MHz ~1 GHz	Fig.12	P
		1 GHz ~10 GHz	Fig.13	P
916(100kbps)	916	30 MHz ~1 GHz	Fig.14	P
		1 GHz ~10GHz	Fig.15	P

NOTE: The measurement results include the all axis measurements. The test cases are selected as the worst cases for all axis.

908.42(9.6kbps) (1-10GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2437.000000	54.87	V	15.3	19.13	74.00
2603.500000	55.35	V	16.2	18.65	74.00
2692.500000	56.90	V	16.9	17.10	74.00
2761.000000	57.38	V	17.2	16.62	74.00
2899.000000	57.07	H	17.0	16.93	74.00
2936.500000	57.27	H	17.4	16.73	74.00

Frequency (MHz)	Average-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2330.000000	42.95	V	15.5	11.05	54.00
2439.000000	43.07	H	15.3	10.93	54.00
2579.000000	43.86	V	16.1	10.14	54.00
2692.500000	44.86	V	16.9	9.14	54.00
2781.500000	45.59	V	17.5	8.41	54.00
2931.500000	45.34	H	17.5	8.66	54.00

908.4(40kbps) (1-10GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2465.500000	54.85	V	15.3	19.15	74.0
2581.500000	56.19	V	16.2	17.81	74.0
2676.500000	57.24	H	16.5	16.76	74.0
2791.000000	57.70	V	17.6	16.30	74.0
2917.000000	57.31	V	17.3	16.69	74.0
2934.500000	56.89	V	17.5	17.11	74.0

Frequency (MHz)	Average-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2449.000000	43.06	H	15.3	10.94	54.00
2582.500000	43.97	V	16.2	10.03	54.00
2691.000000	44.88	V	16.9	9.12	54.00
2789.500000	45.70	V	17.6	8.30	54.00
2928.500000	45.20	H	17.5	8.80	54.00
2938.500000	45.37	V	17.4	8.63	54.00

916(100kbps) (1-10GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2445.000000	55.50	H	15.1	18.50	74.0
2543.000000	55.38	V	15.3	18.62	74.0
2663.000000	56.44	V	16.3	17.56	74.0
2794.000000	57.00	V	17.5	17.00	74.0
2897.500000	57.56	V	17.0	16.44	74.0
2930.000000	57.05	H	17.6	16.95	74.0

Frequency (MHz)	Average-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2461.000000	42.94	V	15.5	11.06	54.00
2581.500000	43.97	H	16.2	10.03	54.00
2690.500000	44.88	V	16.9	9.12	54.00
2791.500000	45.64	V	17.6	8.36	54.00
2928.000000	45.20	H	17.5	8.80	54.00
2931.000000	45.38	V	17.5	8.62	54.00

See ANNEX B for test graphs.

Conclusion: PASS

Note:

A "reference path loss" is established and the A_{Rpl} is the attenuation of "reference path loss", and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

P_{Mea} is the field strength recorded from the instrument.

The measurement results are obtained as described below:

$$\text{Result} = P_{Mea} + A_{Rpl} = P_{Mea} + \text{Cable Loss} + \text{Antenna Factor}$$

ANNEX B: TEST GRAPHS

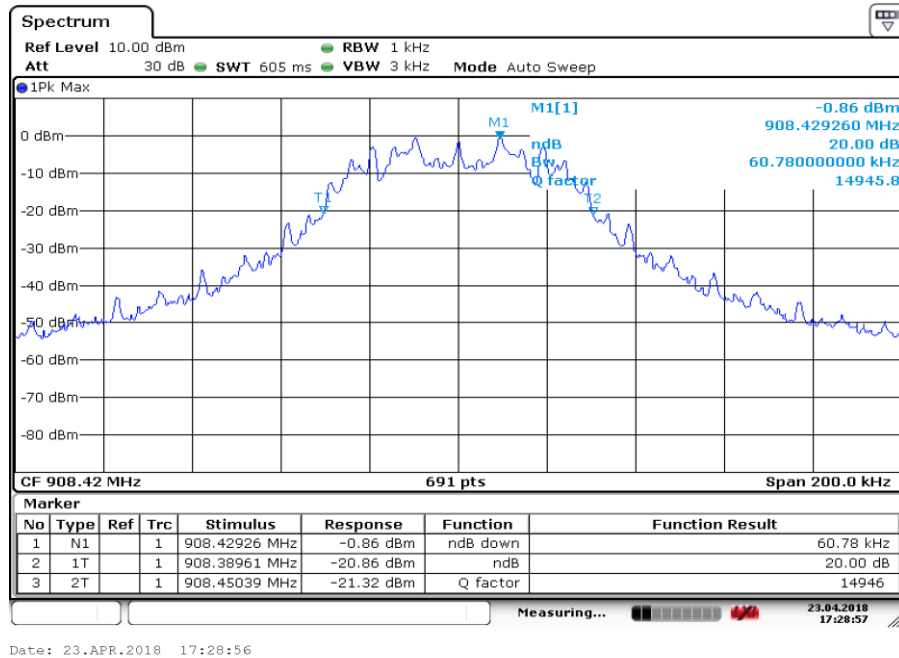


Fig.1 Occupied 20dB Bandwidth (908.42MHz, 9.6kbps)

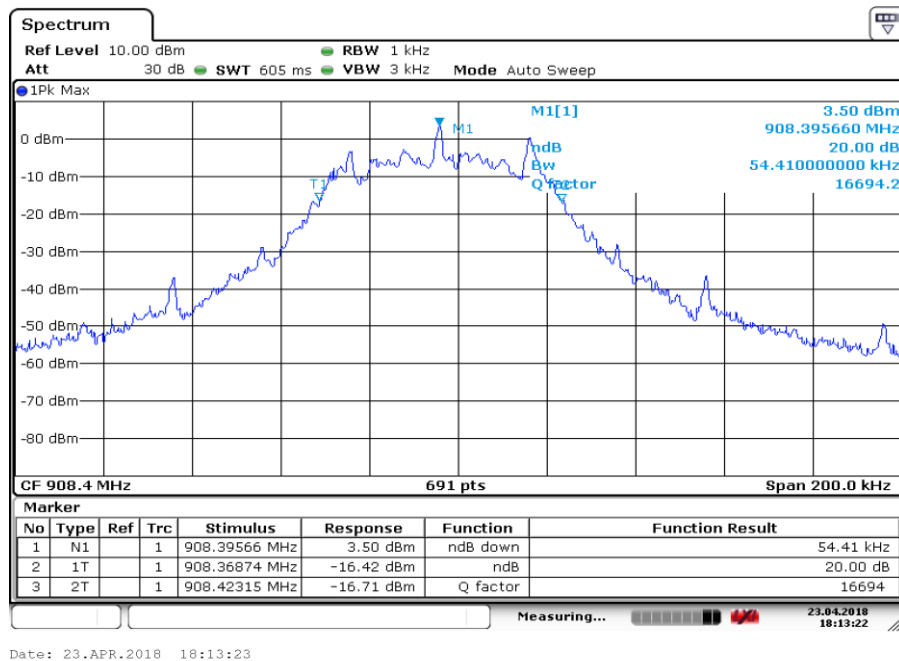


Fig.2 Occupied 20dB Bandwidth (908.4MHz, 40kbps)

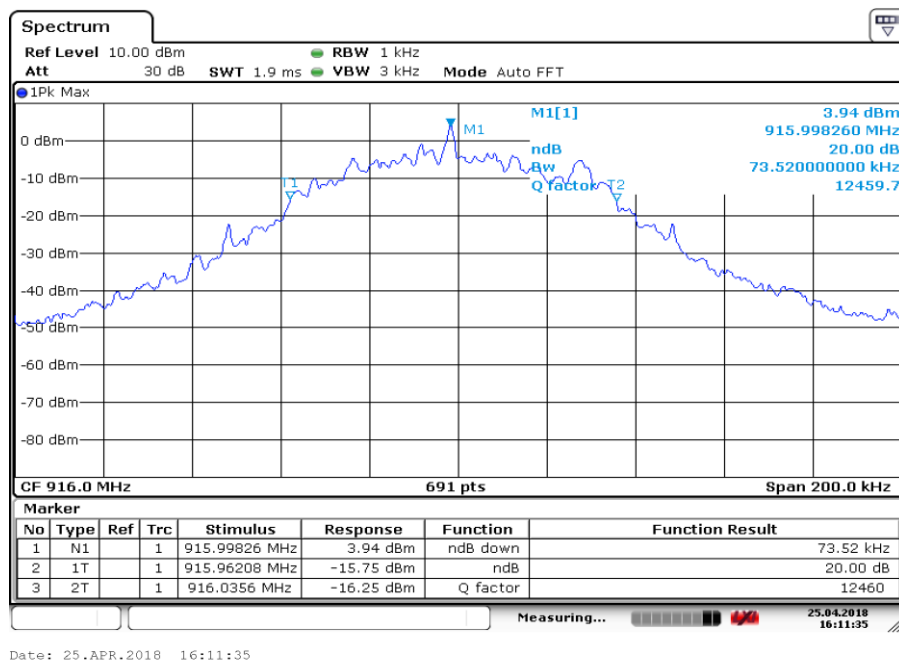


Fig.3 Occupied 20dB Bandwidth (916MHz, 100kbps)

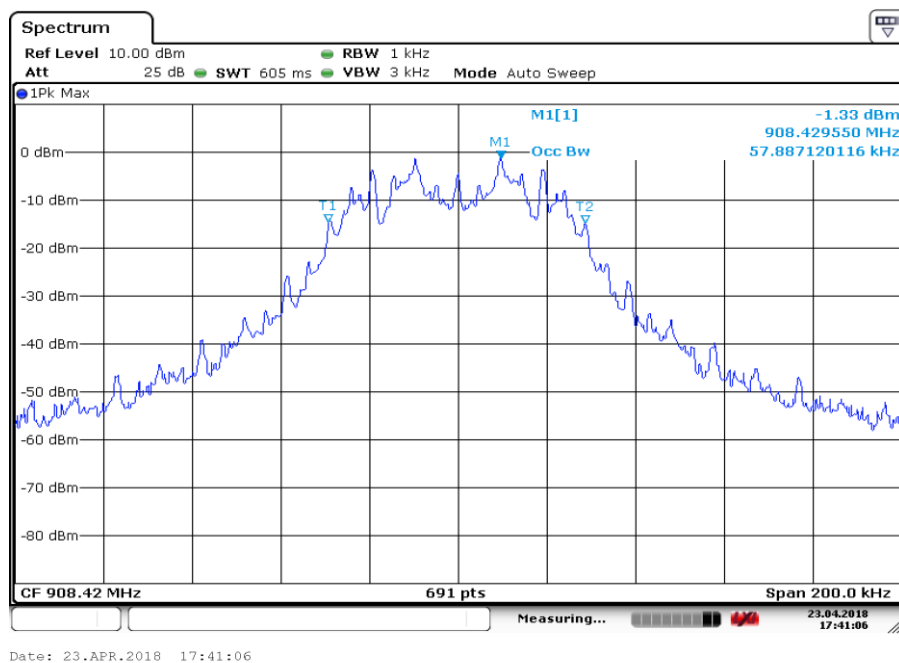


Fig.4 Occupied Bandwidth (908.42MHz, 9.6kbps)

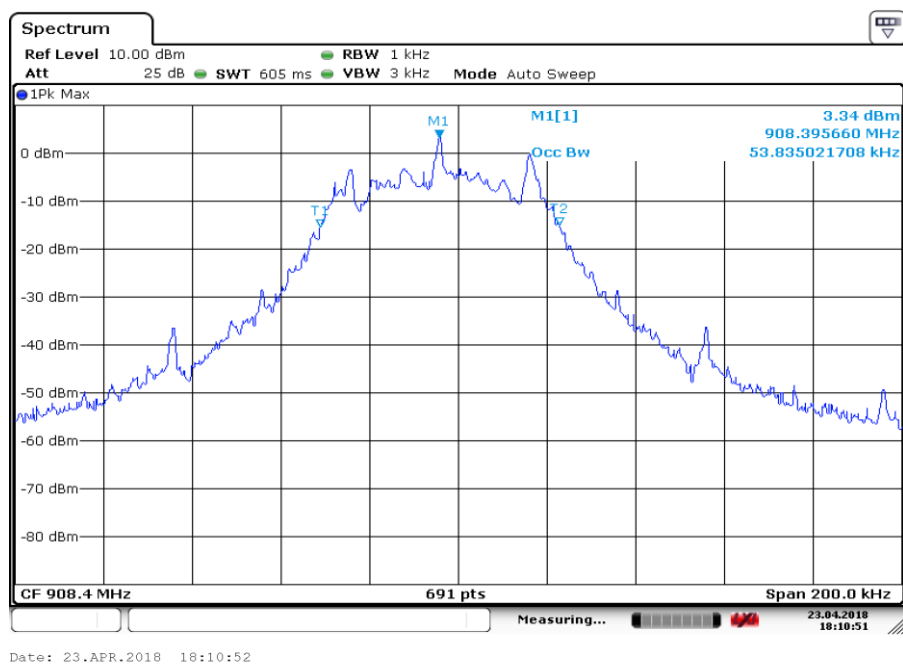


Fig.5 Occupied Bandwidth (908.4MHz, 40kbps)

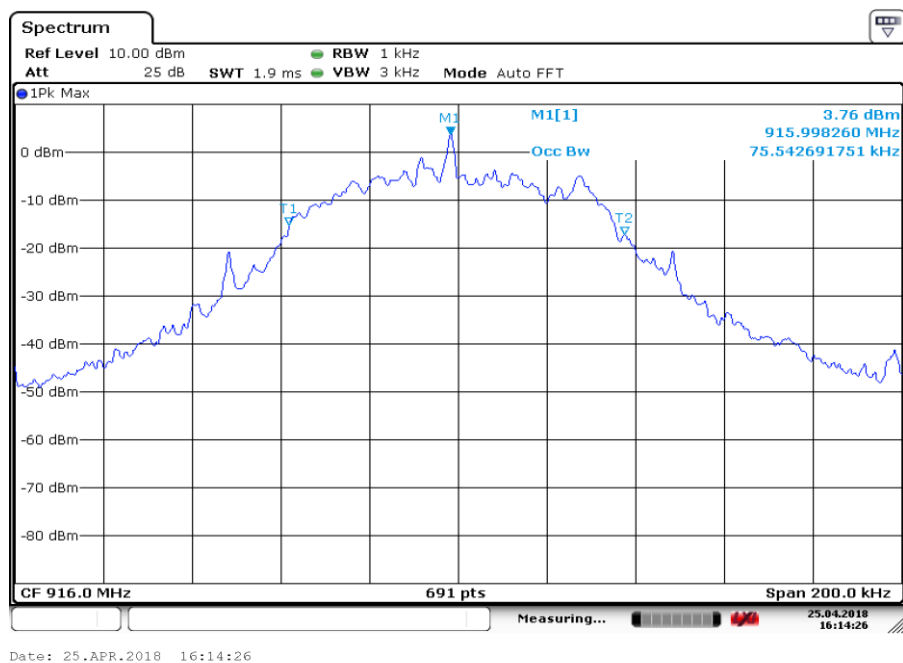


Fig.6 Occupied Bandwidth (916MHz, 100kbps)

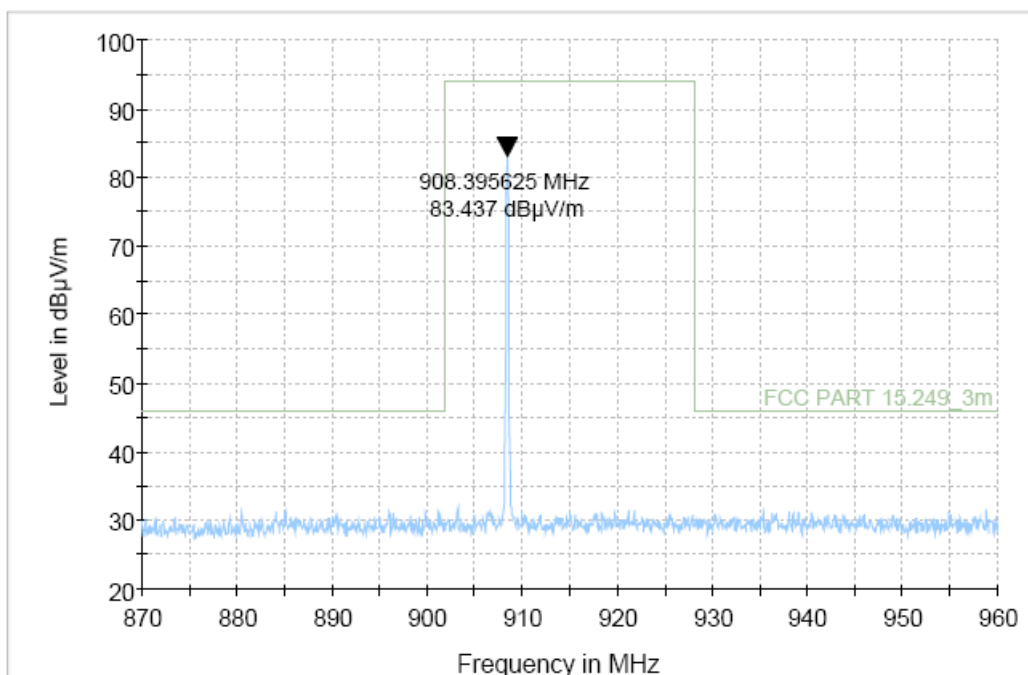


Fig.7 Radiated Emission (908.42MHz, 9.6kbps)

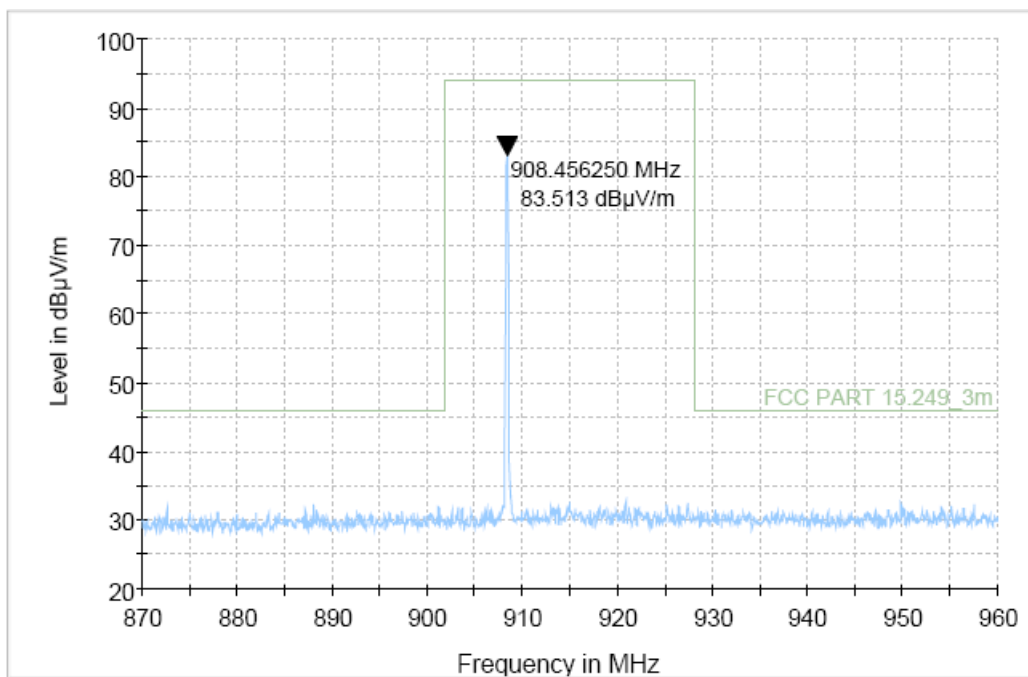


Fig.8 Radiated Emission (908.4MHz, 40kbps)

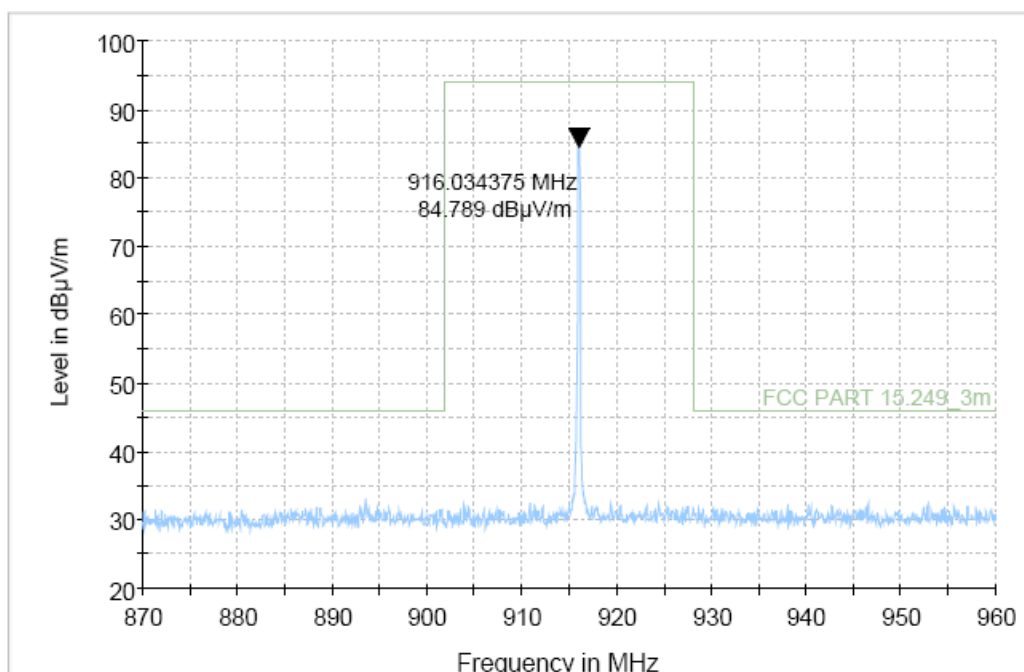


Fig.9 Radiated Emission (916MHz, 100kbps)

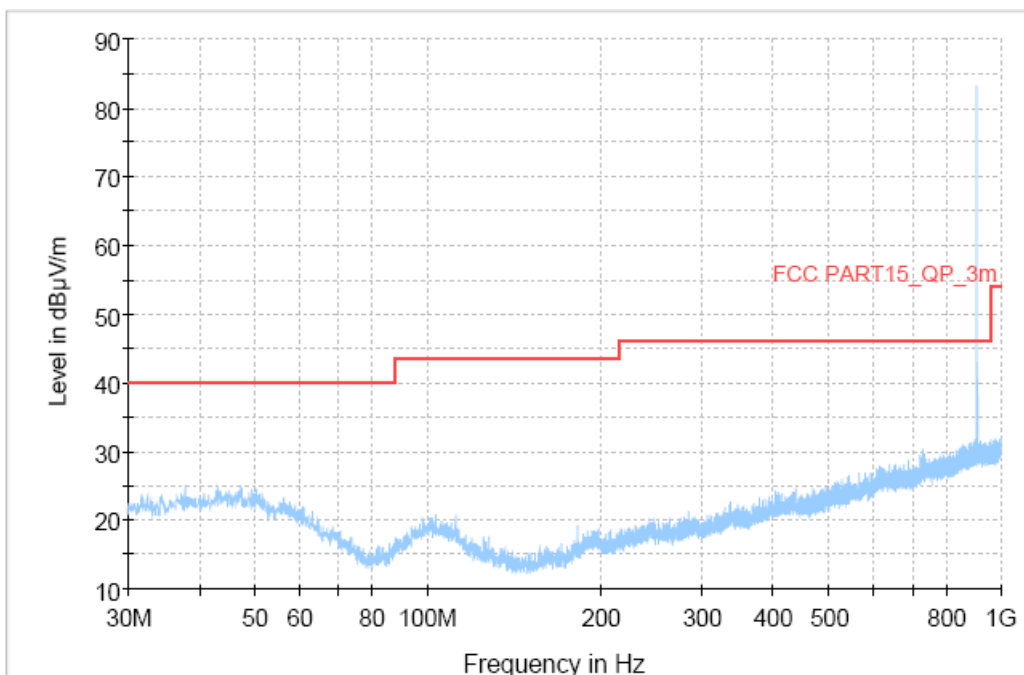


Fig.10 Radiated Spurious Emission (908.42MHz, 9.6kbps, 30MHz-1GHz)

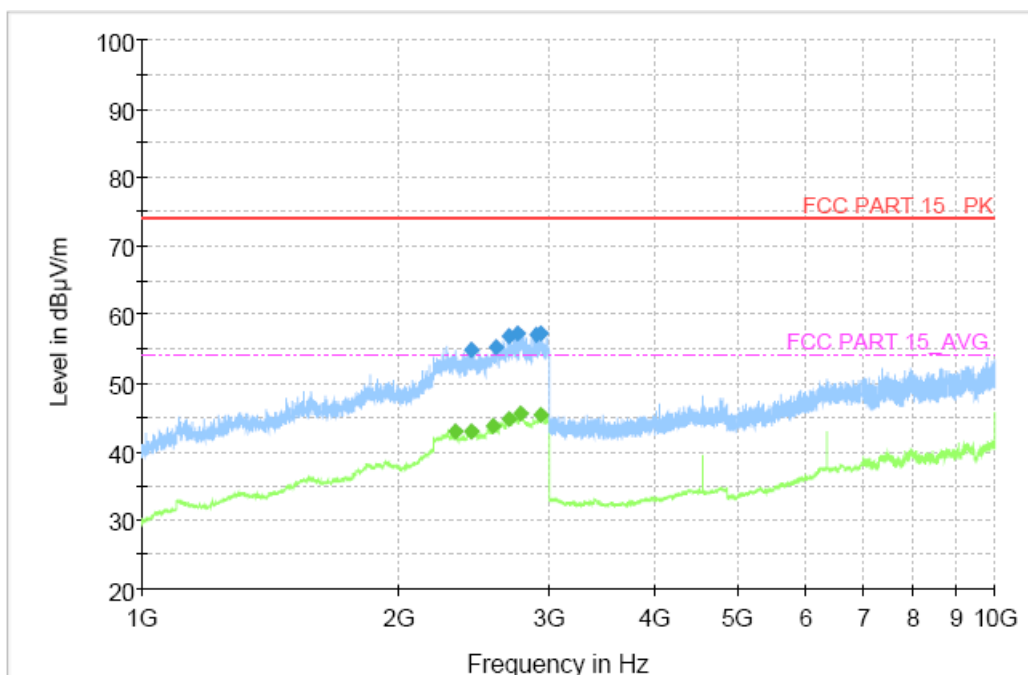


Fig.11 Radiated Spurious Emission (908.42MHz, 9.6kbps, 1GHz-10GHz)

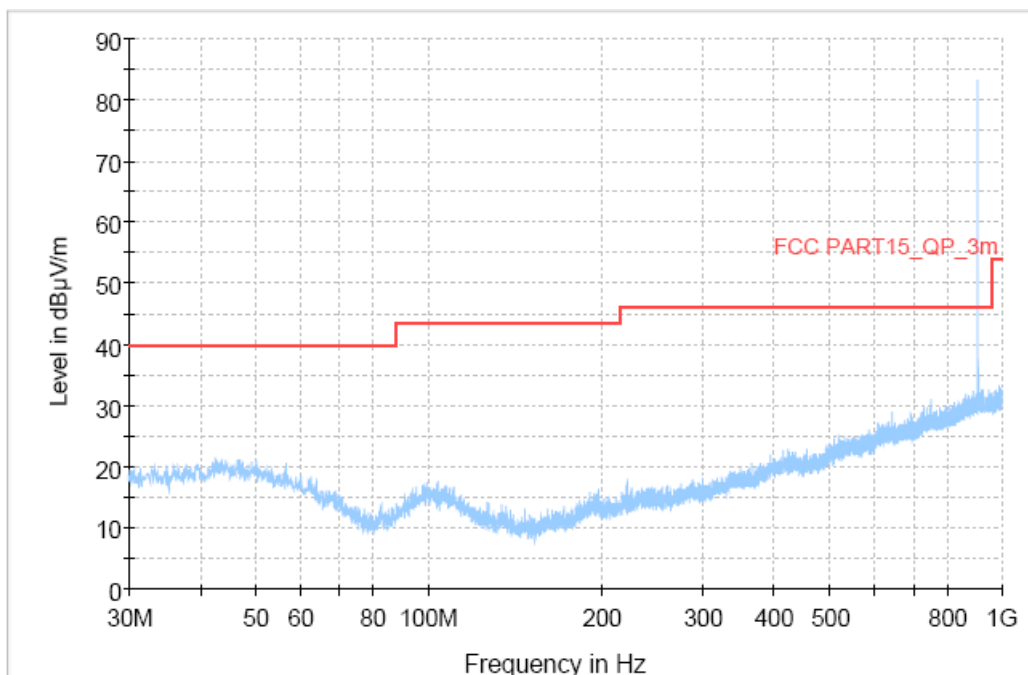


Fig.12 Radiated Spurious Emission (908.4MHz, 40kbps, 30MHz-1GHz)

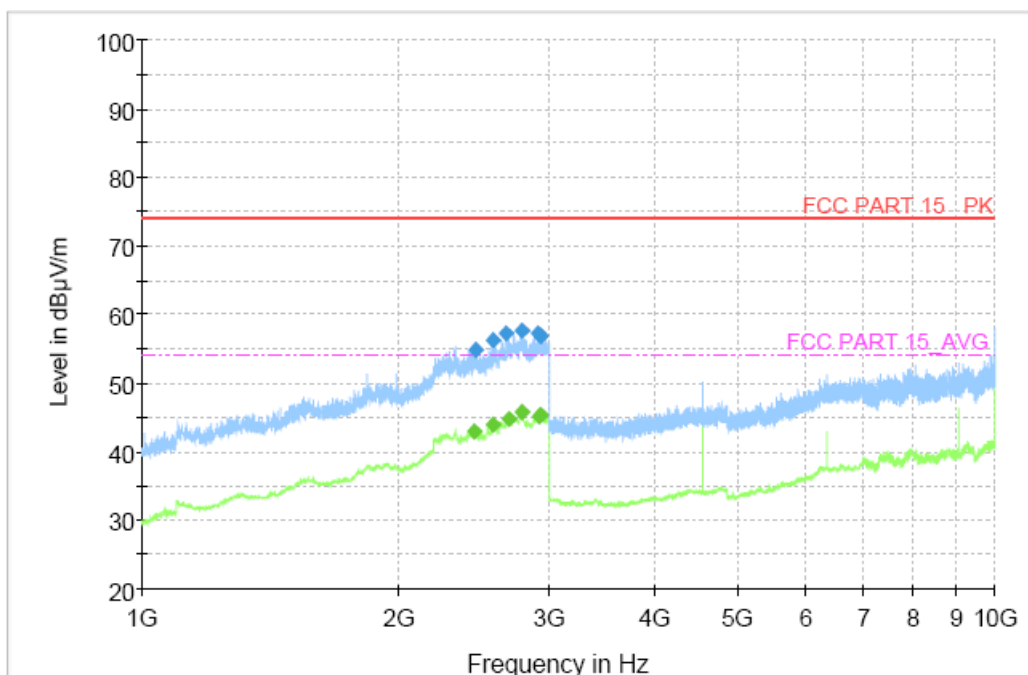


Fig.13 Radiated Spurious Emission (908.4MHz, 40kbps, 1GHz-10GHz)

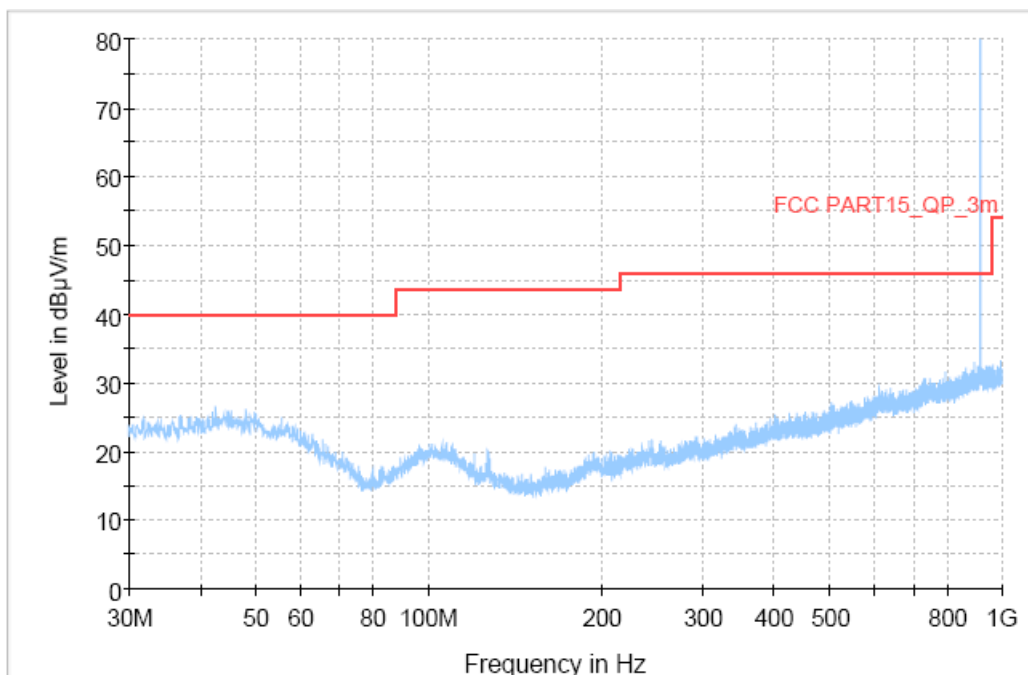


Fig.14 Radiated Spurious Emission (916MHz, 100kbps, 30MHz-1GHz)

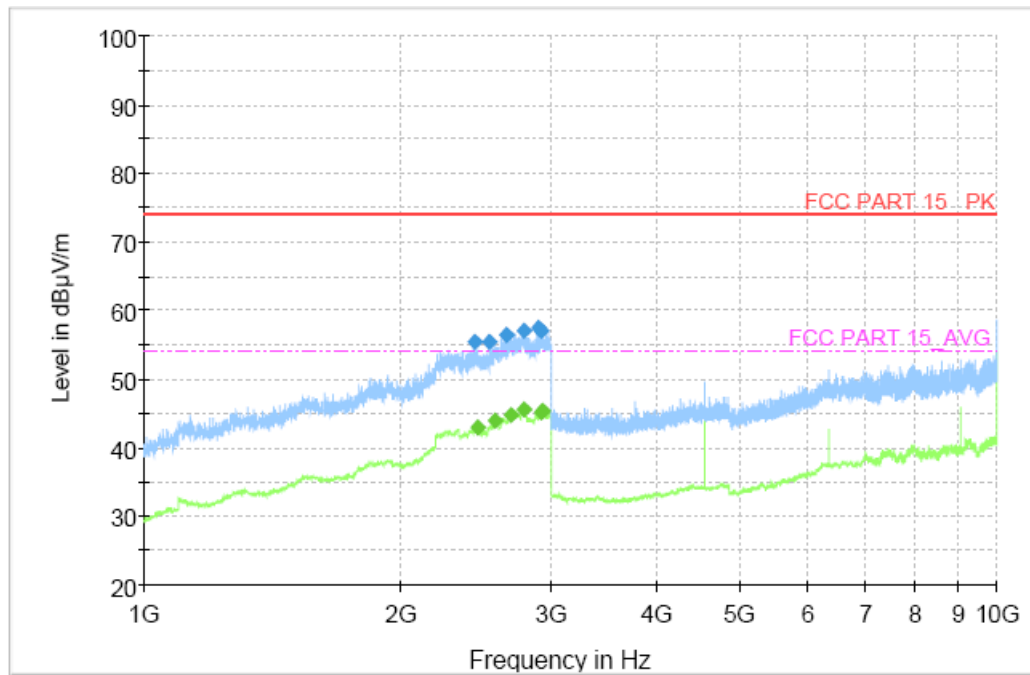


Fig.15 Radiated Spurious Emission (916MHz, 100kbps, 1GHz-10GHz)

ANNEX C: Persons involved in this testing

Test Name	Tester
Occupied 20dB Bandwidth	Lin Kanfeng, Tang Weisheng
Occupied Bandwidth	Lin Kanfeng, Tang Weisheng
Radiated Emissions	Lin Kanfeng, Tang Weisheng

*****END OF REPORT*****